

Printed-Wiring Board Resistor Test File Specification

DOCUMENT IDENTIFIER: A-SP-ELMF591-00-0000 Rev A, 17-Jul-1990

ABSTRACT: This document details the file contents and format for a printed-wiring board (PWB) embedded Resistor Test File (RTF). An RTF provides a method for organizing and transferring complete resistor information between Design and Manufacturing functions. RTFs are required elements of Digital's 50-level data sets for all products that include buried resistor technology.

APPLICABILITY: This document is mandatory for personnel responsible for testing high technology PWBs that require data-driven embedded resistor testing.

STATUS: APPROVED 17-Jul-1990; use VTX SMC for current status.

This document is confidential and proprietary, and is the property of Digital Equipment Corporation. It is an unpublished work protected under the Federal copyright laws.

©Digital Equipment Corporation. 1990. All rights reserved.

Printed-Wiring Board Resistor Test File Specification

DOCUMENT IDENTIFIER: A-SP-ELMF591-00-0000 Rev A, 17-Jul-1990

REVISION HISTORY: No previous revision exists.

Document Management Category: Component Handling and Test (MC)
Responsible Department: Semiconductor Interconnect Technology/PWB
Responsible Person: Michael Hill

APPROVAL: This document has been reviewed and recommended for approval by the Technical Review group for its category.

Michael Hill - PWB Group Quality Manager

Direct requests for further information to:

Lee Stogner
Use \$ VTX ELF for the latest location information.

Use VTX SMC to order copies of this document from Standards and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

CONTENTS

1 INTRODUCTION	1
2 FILE TRANSFER	1
3 FORMAT CONVENTIONS	1
4 FILE STRUCTURE	2
4.1 GROUP PARAMETERS LINE	2
4.2 RESISTOR LOCATION LINE	3
4.3 REMARK LINE	3
4.4 END OF FILE	4
5 DATA DEFINITION	4
6 FILE LIMITATIONS	6
7 FORMAT REQUIREMENTS FOR EXTERNAL PWB SUPPLIER	8
7.1 MEDIA FORMAT	8
7.2 FILE FORMAT CONVENTIONS	8
FIGURES	
1 RTF Test Point Locations (Side 2 View)	7

1 INTRODUCTION

This specification describes the structure, data definitions, and limitations of a Resistor Test File (RTF). The RTF is the file type that transfers complete resistor information between Design and Manufacturing functions. Boards Manufacturing then uses the information for electrical testing of buried resistors within a printed-wiring board (PWB).

This specification establishes RTFs as required elements of a Digital 50-level data set for all products that include buried resistor technology.

The intent of this specification is to define a simple file format that allows RTFs to provide a method for:

- Transferring complete resistor information between Design and Manufacturing
- Organizing data in a format that can be used as input to resistance testers
- Organizing data in a common format that can be translated by Manufacturing to support the specific data requirements of a variety of electrical testers

2 FILE TRANSFER

Easynet is the preferred vehicle for transferring files between design sites and Manufacturing.

RTF files are available on-line through the Manufacturing Data Access (MDA) system for applicable products.

3 FORMAT CONVENTIONS

The following format conventions are required for RTFs. Refer to heading 7 for external supplier requirements.

- Format an RTF using VAX/VMS ASCII file format conventions.
- End each line with a VAX Record Management Services (RMS) variable-length implied-carriage-return.
- Use the Digital Multinational Character set.
- Separate each data field with a comma.

Refer to heading 7 for additional file conventions.

4 FILE STRUCTURE

RTFs consist of four types of elements.

- a. Group Parameters Line
- b. Resistor Location Line
- c. Remark Line
- d. End of File Indicator

The following subheads describe the four elements.

4.1 GROUP PARAMETERS LINE

The Group Parameters Line defines the characteristics of a group of related resistors.

The first character on the Group Parameters Line must be the equal (=) sign.

The Group Parameters apply to all resistors named in the Resistor Location Lines until the next occurrence of a Group Parameters Line.

Note that an RTF may contain many identical Group Parameters Lines. For example:

=HL,GT,GN,RV,TH,TL,LN

where:

HL is the hierarchy level for the resistors in a group, expressed as a numeric.

GT is the group type such as discrete, parallel, or series, expressed as D, P, or S.

GN is the group number that identifies unique combinations of resistors.

RV is the designed value for all resistors that follow, expressed in ohms.

TH is the resistor + or high tolerance, expressed as a percent.

TL is the resistor – or low tolerance, expressed as a percent.

LN is the layer name of the resistive layer.

4.2 RESISTOR LOCATION LINE

The Resistor Location Line identifies the resistors defined by the preceding Group Parameters Line.

The first character on the Resistor Location Line must be an alpha character.

Note that each Resistor Location Line is usually followed by a Remark Line. For example:

RD,XY1,AXY1,XY2,AXY2,RU
;LSN1,LSN2

where:

RD is the reference designator for the resistor under test.

XY1 is the nearest probable network point on the complete PWB that is connected to one side of the buried resistor.

AXY1 is an alternate probable network point that is connected to the same side of the resistor as the nearest probable network point. If no alternate exists, this field contains the single character A.

XY2 is the nearest probable network point on the complete PWB that is connected to the opposite side of the buried resistor.

AXY2 is an alternate probable network point to the opposite side of the resistor. If no alternate exists, this field contains the single character A.

RU is the resistor usage, expressed as P for a primary resistor and S for a spare resistor.

LSN1 is the logical signal name that corresponds to the network that is probed at XY1. (See subhead 4.3, Remark Line.)

LSN2 is the logical signal name that corresponds to the network that is probed at XY2. (See subhead 4.3, Remark Line.)

4.3 REMARK LINE

The character in the first position of a Remark Line must be a semicolon (;).

The Remark Line may contain a maximum of 64 characters, excluding the semicolon.

Remark Lines are optional and can appear throughout the file.

Note that the LSN1 and LSN2 fields in the Resistor Location Line shown in subhead 4.2 are included as a Remark. Signal names should be provided whenever practical to aid in debugging.

4.4 END OF FILE

The logical end of file must be indicated by a period (.) in the first position of the last line of the file.

5 DATA DEFINITION

Each group of resistors (parallel, serial, and discrete) is defined by a set of Group Parameters as described in subhead 4.1. Resistor identification data is provided by the data elements described in subhead 4.2. This identification data includes elements such as reference designators and XY probe locations. Discrete resistors that comprise parallel or serial resistor combinations within associated groups are identified by the same reference designation.

The following paragraphs provide detailed definitions of the Group Parameter and Resistor Location data fields.

- a. The hierarchy level (HL) relates parallel and/or serial resistor groups to their discrete groups.
 - An HL value of 1 indicates that a group is not a subgroup of any other group.
 - An HL value of 2 indicates that a group is a part of the preceding group with an HL value of 1.
 - An HL value of 3 indicates that a group is a subgroup of the preceding group with an HL value of 2. This continues for HL values of 4, 5, and so on.
 - Typically, a parallel or serial resistance group with an HL value of 1 precedes a set of discrete groups with HL values of 2.
- b. The group number must be expressed as xxxxx, (for example, 00001 for group 1).
- c. Resistor values must be expressed as xxxx, (for example, 0055 for 55 ohms).
- d. Resistor tolerances are values taken from the Engineering data base. They are not testing tolerances.
 - Resistor high tolerance percent limit shall be expressed as +xx with a plus sign (for example, +10 for +10 percent). Resistor low tolerance limit shall be expressed as -xx with a minus sign (for example, -05 for -5 percent). The plus and minus (+/-) symbols are included only to make the file more readable. The percents are percents of the nominal resistor value.
 - Resistor values and tolerances pertain to all reference designators listed for the group. If the group consists of parallel or serial resistors, these values represent the parallel or serial equivalent resistance. If the group consists of discrete resistors, these values represent the resistance for the single resistors.

- e. The layer name must be expressed as xxx (for example, L2A, L2B, L6, L14, and so on).
- f. Reference designators shall be an 8-character alphanumeric field with trailing blank suppression.
- g. The nearest probable point is usually a through-pin or via location on the completed PWB. XY coordinates for through-pins or vias are located in the center of the drilled hole or pad.
- h. The XY coordinates for parallel or serial groups indicate the physical probe points for measuring or testing the equivalent parallel or serial resistance. Similarly, for discrete resistor groups, these XY coordinates indicate the physical probe points for the single resistors.
 - XY coordinates, measured from Digital H Master Zero origin on side 2, shall be selected on 100 mil increments.
 - XY coordinates shall be expressed as XXXXXXXYXXXXXX with no leading or trailing zero suppression. XY coordinate units shall be expressed in tenths of mils.

Examples	X000250	equals	0.025 inch (0.054 cm)
include:	X030000	equals	3.0 inches (6.45 cm)
	X067200	equals	6.72 inches (14.45 cm)
	X128930	equals	12.893 inches (27.720 cm)
- i. The logical signal name shall be a 30-character alphanumeric field with trailing blank suppression.

6 FILE LIMITATIONS

An RTF includes data for all resistors on a PWB. If a specific testing process has a test point limit, the RTF may require subdivision by the manufacturing data user.

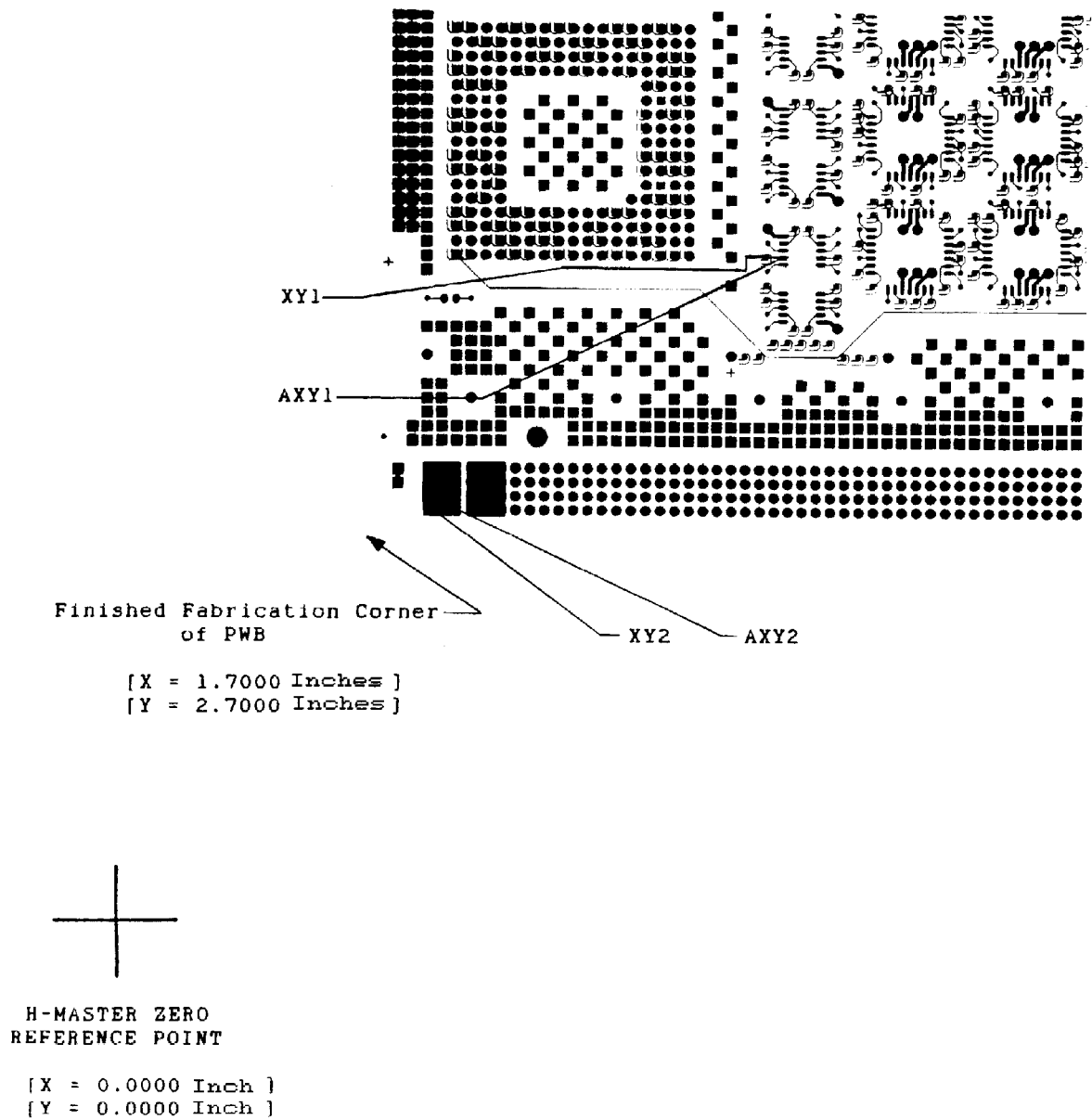
There is no minimum probe separation requirement, but most probes will be on a 100-mil grid. For any specific testing process that requires separation minimums, it may be necessary to use the alternate probable point.

Figure 1 shows a Side 2 view of test point locations.

The following is an example of an actual RTF listing.

```
=1,D,00001,0055, +05, -05,L2A
U5056,X030000Y043000,AX010100Y043000,X034000Y043000,
AX014000Y044000,P
;CONSOLE_UP,VCC6
U5055,X041000Y049000,A,X036000Y049000,AX016000Y049100,S
;NEWBUSREAD4,VCC8
;
; This is a sample of two discrete resistors and their parallel
; equivalent:
=1,P,00002,0031, +10, -10,L2A
U132,X030200Y043000,AX001200Y043000,X0342000Y043000,A,P
;CONSOLE_DOWN,VCC6
=2,D,00003,0080, +05, -05,L2A
U132,X030200Y043000,AX001200Y043000,X0342000Y043000,A,P
;CONSOLE_DOWN,VCC6
=2,D,00004,0050, +05, -05,L2A
U132,X030200Y043000,AX001200Y043000,X0342000Y043000,A,P
;CONSOLE_DOWN,VCC6
;
; This is a sample of two discrete resistors and their serial
; equivalent:
=1,S,00005,0130, +10, -10,L2A
U155,X050000Y050000,A,X050000Y050000,A,P
;CONSOLE_DOWN,VCC6
=2,D,00006,0080, +05, -05,L2A
U155,X050000Y050000,A,X040000Y040000,A,P
;CONSOLE_DOWN,CONSOLE_INT
=2,D,00007,0050, +05, -05,L2A
U155,X040000Y040000,A,X050000Y050000,A,P
;CONSOLE_INT,VCC6
.
```

Figure 1: RTF Test Point Locations (Side 2 View)



7 FORMAT REQUIREMENTS FOR EXTERNAL PWB SUPPLIER

The following paragraphs describe the standard media and file format conventions for RTFs.

7.1 MEDIA FORMAT

Standard media for RTF test data files shall be double-density 1.2 megabyte formatted 5.25 inch (11.29 cm) diskettes. Diskettes shall be IBM/AT TM compatible, MS-DOS ®V3.1 or higher. Diskettes shall be divided into 80 tracks (numbered from 0 to 79) with 15 sectors per track. Files are also available on 0.5 inch (1.07 cm) width, nine track magnetic tape (1600 BPI) with ANSI-standard format and labels.

7.2 FILE FORMAT CONVENTIONS

Files shall be formatted as MS-DOS (V3.1 or greater) ASCII text files. Each line in the file shall end with an ASCII carriage return and line feed.

TM IBM/AT is a trademark of International Business Machines Corporation

® MS-DOS is a registered trademark of Microsoft Corporation.

READER COMMENTS
Your comments and suggestions will help Standards and Methods Control improve their services and documents.

Did you request this document? _____ If so, did it arrive within a satisfactory period of time? _____ Please comment.

What are your impressions of this document? Consider format, organization, completeness, readability, and illustrations.

_____ **FOLD ON THIS LINE** _____

Did you find technical or clerical errors in this document? If so, please specify the page number(s) and the error(s).

Are the instructions for the update package clear? _____
Was an index available? _____ If not, is one needed? _____
Do you have other suggestions for improving this document?

The following information is optional:

Name _____ Mailstop _____
Department _____ Node _____

Send your comments to JOKUR::PROJECTS, or fold, staple, and send this page through interoffice mail to:

READERS' COMMENTS
STANDARDS AND METHODS CONTROL
NRO4/D4